The First Stars and Galaxies in the Universe

The first luminous objects to form in the universe were massive stars initially composed of only hydrogen and helium, approximately 100 times the size of our Sun. Cosmic structures form hierarchically—smaller objects merge together to form progressively larger objects. A fraction of such stars ended their lives as supernovae, whose ejecta—material expelled in a stellar explosion—enriches the intergalactic medium with the first elements heavier than Lithium. Some of these supernovae will be observable with NASA's James Webb Space Telescope. Sixty percent of this enriched gas is incorporated into the first galaxies, which are up to a factor of 10,000 times less massive than the Milky Way.

Characteristics of the simulated galaxies will help interpret future observations of the most distant galaxies in the universe with the James Webb Space Telescope, a large, infrared-optimized space telescope scheduled for launch in 2014. These simulations provide the public with knowledge of the first luminous objects in the universe, and help answer some philosophical questions about our cosmic origins.

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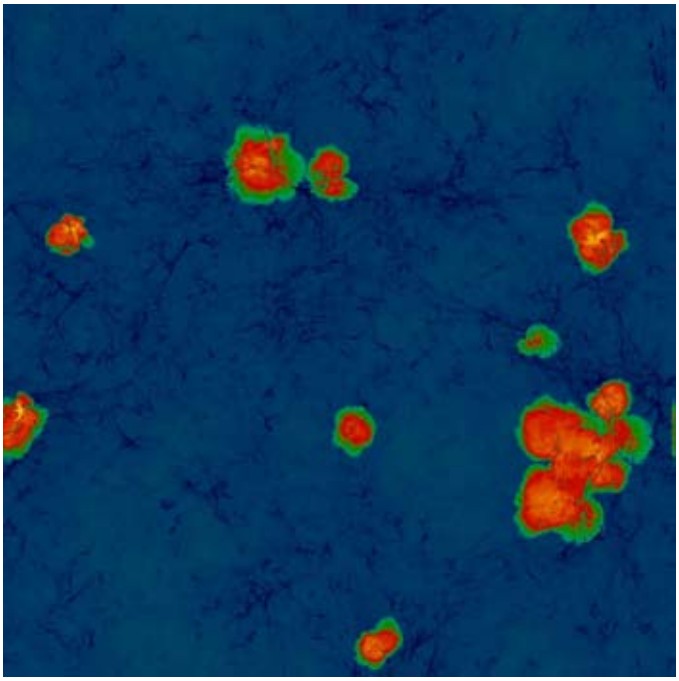
Volume rendering of the heated gas surrounding one of the first stars in the universe, formed 200 million years after the Big Bang. Blue and red coloring indicates cold and hot gas, respectively. The field of view is 10,000 light years. (Ralf Kaehler, Zuse Institute Berlin)



Projection of ionized (red/green) and neutral (blue) hydrogen, spanning 250,000 light years. The bubbles of ionized hydrogen are created by the radiation emitted by the first stars. (John Wise, Princeton University)

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